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THE FAMILY CLAUSIIDAE (COPEPODA,
CYCLOPOIDA)

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There has crept into the literature on poecilostome Cyclopoida a misconception of the family Clausiidae. This seems in part, at least, to be traceable to the fact that in his diagnosis of this group, G. O. Sars (1918) did not sufficiently clarify its status, and some workers gained the impression that he was erecting a new family. To what extent he was aware of the discussions in the literature, it is not possible to judge. His own discussion is very brief. He mentions *Clausia* as the type of the family, refers to it his new genus *Conchocheres*, and suggests that *Myicola* Wright might also be included in the group.

Monod and Dollfus (1932) in their important and useful summary of the copepod parasites of Mollusca, considered that Sars was the author of this family. They added to it a few other genera, and stated that it is evidently closely allied to the Ergasilidae. In a later paper of this series (1934) they pointed out that the family was poorly defined and perhaps not a natural group, because one of the characters accepted as fundamental by them and Sars, that is, the absence of the maxilliped in the female, might be a generic character. C. B. Wilson (1932) had referred *Myicola* to the Lichomolgidae, and influenced by this, Monod and Dollfus suggested that the Clausiidae might in time be absorbed by the Lichomolgidae.

Yamaguti (1936) created, without diagnosis, a family Myicolidae, in which he placed *Myicola* and *Pseudomyicola*, a new genus. To the Clausiidae he referred, without comment, several other Japanese genera and species commensal in Mollusca.

There has thus grown up a concept of the family Clausiidae based upon the premises that Sars is its author, that it is comprised of mollusk parasites or commensals, that the female lacks the maxilliped, and that it is closely allied to the Ergasilidae and Lichomolgidae. The facts, however, are quite different. It is necessary only to trace the references to the type genus, *Clausia*, through the literature, to find that the fam-

ily was instituted by Giesbrecht, that it is composed of copepods mostly associated with annelids, that the maxilliped is present in the female, and that the opinion is held that the group is most closely allied to the Clausiidae.

Clausia lubbockii was described by Claparède in 1863 from specimens collected in a plankton tow. Giesbrecht (1893) redescribed the species from a specimen found in a vial containing marine annelids that occurred on oyster shells. Since the characters of the copepod exhibit the modifications and reductions characteristic of annelid commensals, he was probably correct in assuming that the association with the worms was not incidental. Giesbrecht's description and illustrations are most excellent, providing the details of all the significant appendages. He refers to those of the oral area as mandible, the first maxilla, the second maxilla, and the maxilliped. This latter appendage is of a reduced nature, unsegmented, insignificant in size and armed apically only with hairs.

In the description of a new genus *Seridium*, Giesbrecht (1895) pointed out that it was closely allied to *Clausia* and to *Rhodinicola* Levinsen (1878), and stated that (p. 226) "diese drei Anneliden Parasiten zu einer engeren systematischen Gruppe (Familie Clausiidae) zusammenzufassen waren." The family is thus attributable to Giesbrecht (1895) not to Sars (1918).

Only two authors have referred directly to Giesbrecht's work—Gravier (1912) and C. B. Wilson (1923). Gravier (p. 67) discussed Giesbrecht's interpretation of the family and added to it his genus *Bactropus*. Wilson referred to the works of Giesbrecht and Gravier and added to their lists a new genus *Pherma* which had been collected from the parapodia of an unnamed annelid.

Chronologically, Sars' diagnosis of the Clausiidae follows Gravier's paper. Throughout his monumental work on the crustacea of Norway, he did not trace the synonymy of families, and it is not always easy to tell even if the family is newly created. In the case of the Clausiidae at least this has been unfortunate. Sars' diagnosis is very broad and in many ways indefinite, as seen particularly in his meaningless description of the mouth parts: "Oral parts more or less imperfectly developed; the posterior maxillipeds being in female rudimentary or quite absent." By "rudimentary" he undoubtedly referred only to those of *Clausia*, by "absent" to the condition in his new genus *Conchocheres*. His description of the posterior antenna as being "distinctly prehensile" is somewhat questionable in the case of *Clausia*. The combined armature of several weak, somewhat modified claws and long setae seems to make the term "subprehensile" more appropriate.

None of these authors referred to the genus *Mesnilia* Canu (1898). Canu did not assign *Mesnilia* to the Clausiidae, but did point out its undoubted resemblance to *Clausia*. It rather appears that he may not have been aware that Giesbrecht had established this family two years before. His suggestion (p. 402) that *Clausia cluthae* T. and A. Scott (1896) should be included in *Mesnilia* rather than in *Clausia* has some merit, although as he emphasized, the knowledge of the oral appendages of this species is imperfect (see below, p. —).

Mesnil and Caullery (1916) further pointed out the similarity of

Mesnilia martinensis to *Clausia lubbockii*. They followed Canu in not referring to the family Clausiidae, or to Giesbrecht's paper on the genus *Seridium*. Their work is of importance in establishing as host of *Mesnilia martinensis*, the annelid, *Polydora flava*.

The references reviewed above constitute the only discussions of the family Clausiidae of which we have knowledge in the literature. It seems desirable that consideration should be given here to the diagnostic characters of the family so far as they can be ascertained, and to the genera that have been, correctly or incorrectly, assigned to the family.

Diagnostic Characters of the Clausiidae

Giesbrecht did not give a formal diagnosis of the family that he had proposed, but in comparing the females of the three genera he drew together in this group, he mentioned the characters he considered basic in showing their relationship. These, which may be taken as outlining the original concept of the family, are:

Structure of the body.

Similarity of the posterior antennae and mouth parts.

Reduction of the thoracic legs in varying degrees.

Association with the Annelida.

In presenting here a diagnosis of the family we do so with certain reservations. The genera are restricted to those which are most adequately described, and the characters include those considered basic by Giesbrecht, except for the structure of the body. The genera of which Giesbrecht had knowledge possessed a similar elongate body, but since it is likely that these similarities could be due to convergence as well as to phylogeny, this cannot be considered a family character. Indeed, it is questionable, at least among the poecilostome Cyclopoida, whether body form is ever more than a specific character. Further, the desirability of reexamination of all the genera and species concerned, is recognized. A truly comprehensive diagnosis can be presented only upon the actual and accurate comparison of specimens of the species involved. In the meantime, the following diagnosis gives a summary of characters upon which pertinent discussion can be based.

Family CLAUDIIDAE Giesbrecht 1895

Diagnosis (emended).—Antennules short, 4-6 segmented. Antenna 3- or 4-segmented, the two terminal segments armed with setae and sub-prehensile claws of varying number and size; the terminal segment showing a definite tendency to reduction and in some cases to an offset lateral position. Mandible reduced in size, with a posteriorly directed terminal claw or modified "cutting" portion, with or without other accessory pieces or setae. The first maxilla stouter or more reduced than the mandible, a simple, elongate lobe bearing setae placed in one or two groups; its basal attachment more laterally situated than that of the mandible from which it is clearly distinct. The second maxilla and the maxilliped varying among the genera. Second maxilla bimerous, the basal segment tending to great expansion, terminal segment a stout claw or a modified claw. Maxilliped present in the female, of a single unmodified segment armed apically with hairs or spinules (*Clausia*) or a simple claw (*Teredicola*) or of 3 or 4 well-defined segments with an

apical (*Rhodinicola* ?) or subapical claw and terminal knob (*Seridium*) or a platelike development of the apex (*Mesnilia*). The maxilliped in the only known male (*Teredicola*) with a long terminal claw.

Legs 1-4 showing various degrees of reduction, both in size of the appendage and segmentation of the rami, some pairs may be completely absent; leg 5 varying in size and segmentation, not always present (see Table I).

Known genera associated with Annelida and Mollusca (*Teredinidae*).

Family type.—*Clausia* Claparède.

Included genera.—*Clausia*, *Seridium*, *Mesnilia*, *Teredicola*.

Inadequately known: *Rhodinicola*.

Discussion of the Genera

There is no question about the inclusion of *Clausia* and *Seridium* in the Clausiidae since Giesbrecht built the original family concept on his knowledge of these genera. Canu pointed out the undoubted resemblance of *Mesnilia* to *Clausia* and it is included here without qualification because it exhibits the important family characters of the antenna, the mandible and the legs. Such differences as exist may be found upon further investigation to be specific rather than generic in nature. The most striking difference is the structure of the female maxilliped, an appendage exhibiting considerable variability throughout this group of genera. Since it is the character that has been most misinterpreted, it is well to stress that this appendage is rudimentary only in *Clausia lubbockii*.

The inclusion of *Teredicola* C. B. Wilson needs some qualification and furthermore is dependent upon the correction of some errors in the description of the type and only known species, *Teredicola typica*. C. B. Wilson (1942, 1944) has wrongly interpreted the segmentation of the body in the female, showing the ovisacs as attached to the segment posterior to the actual genital somite. This error has been corrected in an illustration, without comment, by Edmondson (1945, fig. 1) who shows not only the correct position but the distinctive membranous process by which the ovisacs are attached to the genital opening. Giesbrecht has noted a similar process in *Seridium*. The antennule is 5-, not 6-segmented. The mandible and first maxilla were not mentioned by Wilson, and though he has accurately described the second maxilla and maxilliped, the drawing of one of these (probably the maxilliped) has been mislabeled "second antenna" (C. B. Wilson, 1942, fig. 1c). Actually, he neglected to figure the antenna which is closely similar to that of the other well defined genera of the Clausiidae. A single claw is borne on an extended portion of the penultimate segment and a group of stiff setae on the small laterally offset apical segment. The mandible has in addition to a broad terminal serrate blade, two dorsally placed accessory pieces, one a stout seta, the other a somewhat flattened foliate structure. The maxilliped of the male is different from that of the female, having two well developed basal segments and an elongate apical claw. Both sexes have two pairs of extremely small legs with 2-segmented rami (Table I).

Teredicola typica differs from the other Clausiidae in having the forepart of the body of the female exceedingly swollen. This does not

exclude it from the group since, as pointed out above, body form is not a family character. The second antenna with its combined armature of setae and single claw; the shortened mandible with its backwardly directed terminal piece; the elongate but simple first maxilla, inserted far laterally to the base of the mandible; and the reduction of the legs are all unmistakable clausiid characters. The armature of the mandible is more complex than the simpler structure shown for *Clausia lubbockii* by Giesbrecht or for *Mesnilia martinensis* by Canu. In this respect alone, *Teredicola* appears more closely allied to the Clausidiidae.

Since the copepod commensals of the Annelida have been little investigated, it is hardly surprising that *Rhodinicola elongata* Levinsen (1878) has not been redescribed. We have followed Giesbrecht in including *Rhodinicola* in the list of clausiid genera, but with reservations. It is not absolutely certain that the species would be recognizable from Levinsen's description. Nor can it with any more certainty be included in the family because the details of the second antenna and mandible are lacking, and the first maxilla has been entirely omitted in the illustrations. The mandible is shown as an unsegmented, posteriorly directed blade. The second maxilla is of simple structure with a stout apical claw, as in *Teredicola*; the maxilliped is composed of four slender segments. The legs are extremely reduced in size, but are described as having the rami completely segmented, differing in this respect from the other genera (see Table I).

Giesbrecht suggested that *Donusa* Nordmann (1864) might be synonymous with *Rhodinicola*. Such an opinion is hardly acceptable in view of the inadequate knowledge of both genera, and some probable inaccuracies in Nordmann's description. According to Nordmann, legs 1-4 are biramose with trimerous rami, which would agree with *Rhodinicola*. His further statement that leg 5 is biramose with 3-segmented rami was considered questionable by Giesbrecht (1895, p. 225). Certainly all the information accumulated since Nordmann, justifies Giesbrecht's objection because no copepod except in the Calanoida has ever been found with biramous fifth legs. It is difficult to understand why C. B. Wilson in his study of the Dichelethiidae (1922) should have characterized Nordmann's description and figures as "clear-cut and decisive" and should have accepted this obviously fantastic condition. In placing the genus in the Dichelethiidae, he undoubtedly followed Nordmann who had referred *Donusa* to this group. Nordmann emphasized that the second antenna of *Donusa* was not developed into a "Klammerapparat" as in *Lamproglena* (Dichelethiidae), a point which makes it seem likely that relationship to the highly modified dichelethiid group is not tenable. It must be concluded that neither the systematic position of *Donusa* nor the identity of its type species can be resolved until the form is again collected and identified with certainty.

In comparing the known annelid parasites having elongate bodies, Giesbrecht also referred to the genus *Sabellacheres* M. Sars (1861). He pointed out that List (1890) had suggested that this genus is very close to or congeneric with *Gastrodelphys*. The only knowledge of *Sabellacheres* is from the original brief Latin diagnosis which though obscurely formulated seems to bear out the opinion of List. Certainly there is no evidence for its inclusion in the Clausiidae, and it is not

TABLE I.
Number of Segments in Legs of the Clausiidae

	Leg 1		Leg 2		Leg 3		Leg 4		Leg 5
	exo	endo	exo	endo	exo	endo	exo	endo	
<i>Clausia lubbockii</i>	3	2	3	2	1	0	reduced to knob and seta	2	
<i>Clausia ciuthae</i>	3	2	3	2	3	1	3	2	
<i>Seridium rugosum</i>	2	1	2	1	2	1	2	reduced to knob and seta	
<i>Rhodinicola elongata</i>	3	3	3	3	3	3	3	2	
<i>Mesnilia martinensis</i>	3	3	3	3	3	0	3	2	
<i>Teredicola typica</i>	2	2	2	2	leg lacking	leg lacking	leg lacking	leg lacking	

believed that Giesbrecht intended so to infer.

The inclusion in the Clausiidae of *Bactropus* Gravier, *Pherma* C. B. Wilson, and *Conchocheres* G. O. Sars, would require modification of the restricted definition given above. These genera are regarded by us as possible members of the group, but their inclusion requires further description or clarification of pertinent appendages. The reduction of the urosome in *Bactropus* and *Pherma* hardly appears a valid reason for excluding them from the family, and it is not so construed. *Bactropus cystopomati* should be readily recognizable from Gravier's description. But since it does have some unusual features, it would be well to know in more detail the exact structure of the oral appendages, particularly the mandible, before its familial position is determined. The same applies to *Pherma*, which indeed, it would be impossible to assign to any family, since C. B. Wilson omitted a description of the oral appendages. Here it should be noted that a genus proposed later by Wilson (*Pestifer*, 1944) has a superficial resemblance to *Pherma* in body form and the structure of the antennule (first antenna) and the possible congeneracy of the two should be investigated. Wilson referred *Pestifer* to the Clausidiidae, but here again evidence of familial position is lacking because the oral appendages were not described.

Similar reasons apply to *Conchocheres*. The lateral extensions of the cephalic somite, the unreduced condition of legs 1-4, the absence of the maxilliped in the female, and its association with a mollusk rather than an annelid, are not necessarily great enough differences to exclude the genus. There is, however, a basic concept in Sars's interpretation of the relationship of the first two pairs of oral appendages that is in contradiction to the facts of structure observed by us and other authors who have examined the recognized genera of this family. He has subscribed throughout his work to the premise that in the *Poecilostoma* the lobelike structure called first maxilla by many other authors is only the palp of the first maxilla, and in his illustrations he has always shown this structure attached to the appendage considered by others as the mandible. In all other illustrations in the literature reviewed here, and in *Teredicola* which we have examined, these two structures are clearly distinct from one another. The form of the first maxilla in *Teredicola* is elongate and it arises laterally far beyond the discernible base of the mandible.

In *Conchocheres*, the mandible (first maxilla of Sars) as pictured *in situ*, is directed posteriorly; the enlarged view shows it to be unsegmented, produced apically to a minute claw and armed with very small accessory spines. Such structures is not ergasilid or lichomolgid in nature, and it is recognized that this apparent simplicity might be interpreted as an example of reduction from the somewhat more developed armature of the clausiid type. Such might also be true of the structure of the second antenna, whose terminal armature consists of a single, short, but very stout claw. The latter is, however, a noticeable departure from the basic clausiid antennal structure, which in combination with the characters of the mandible and the lack of reduction in legs 1-4, may indicate that *Conchocheres* belongs to a different systematic group. It would therefore be well that inclusion in or consequent modification of the family be reserved until reexamination of the

genus determines the actual relationship of the oral appendages. Even with exact knowledge, it will probably be necessary to await discovery and adequate elucidation of other related genera before a proper evaluation of these characters can be made.

Of the genera that have been erroneously ascribed to the Clausiidae, either directly or by inference, the following dispositions may be made.

Mycicola R. R. Wright, referred to this family by Sars (1918) and Monod and Dollfus (1932), was placed in the Lichomolgidae by Pelseneer (1928) and C. B. Wilson (1932) and, by inference, in a family Mycolidae, erected without diagnosis, by Yamaguti (1936). The systematic position of *Mycicola* is without doubt that ascribed to it by its author, who stated quite clearly (Wright, 1885, p. 120): "it occupies a position intermediate between *Lichomolgus* and *Ergasilus*."

A species described by Williams (1907) as *Lichomolgus major* and erroneously referred to *Mycicola* by C. B. Wilson (1932) was placed in the Clausiidae by Monod and Dollfus (1934, p. 316). This species has been made the type of a new genus, *Myocheres* M. S. Wilson (1950). It is undoubtedly allied to the Clausiidae rather than to the Ergasilidae or Lichomolgidae. It has not here been placed in the Clausiidae because of the lack of reduction in the legs and the difference in the apical pieces of the mandible, which exhibit unique modifications. That it may form with other as yet unknown forms, a subdivision of the Clausidiidae, or a separate allied family, is possible. On the other hand, when more knowledge is available, the Clausiidae may come to be interpreted or modified in such a way as to include it.

Monod and Dollfus (1932) included *Mytilicola* Steuer and *Trochicola* Dollfus. We hesitate to suggest any disposition of these highly modified forms, but certainly they do not appear from present knowledge to be referable to the Clausiidae. The absence of the mandible and the maxilliped in the adult may well be only generic characters, but the large prehensile second antenna removes them from possible consideration as members of the Clausiidae. Hockley (1951) has described the mandible of *Mytilicola intestinalis* in an early copepodid stage. The simplicity of its structure gives no indication of relationship to other genera. In a recent paper, Humes (1954) has presented a good summary of the taxonomic studies on *Mytilicola* and has both illustrated and tabulated the specific differentiation within the genus. He raises the question of the seemingly possible congeneracy of *Mytilicola* and *Trochicola*.

The inclusion of *Lecanurius* Kossmann (1877) as suggested by Monod and Dollfus (1932) cannot be justified on the basis of its description. The genera proposed by Pelseneer (1928), also suggested for inclusion by Monod and Dollfus (1932, footnote, p. 154), are inadequately described, the oral appendages and second antennae entirely unknown; their identity is establishable only from types or topotypes. This has been recently ably done for *Tocochoeres cylindraceus* by Stock (1954) who has placed the genus correctly in the clausidiidae. Stock further mentions that Pelseneer's types do not appear to be in existence. *Panaetis* Stebbing, originally considered by Monod and Dollfus as a clausiid, was more correctly assigned by them (1934) to the Lichomolgidae. Such a disposition is also more accurate for the genera *Philococoncha* and *Paraphilococoncha* placed in the Clausiidae by their author, Yamaguti (1936).

Both of these have a characteristic lichomolgid type mandible.

T. Scott (1902) proposed a new genus and species, *Pseudopsyllus elongatus*, which he compared to *Clausia*. It is evident from the structure of the maxilliped that the specimen described by Scott was a male, and not a female as he had supposed. This was the only oral appendage described so that the actual identity of Scott's specimen is not determinable, nor can it be judged if it represents a valid genus. The structure of the second antenna is of the clausiid or clausidiid type. The legs are too well developed to admit the form to the Clausiidae in the present restricted definition.

Systematic Position of the Clausiidae

The supposed relationship of the Clausiidae to the Ergasilidae and Lichomolgidae has been based upon the erroneous interpretation that has recently been given to this family, and is not tenable. On the other hand, the recognition by Giesbrecht and Canu of structural similarities between the Clausiidae and the Clausidiidae has a basis in fact as well as considerable merit. These two authors have presented the most complete and seemingly accurate studies of the genera assignable to the Clausiidae. They have also studied quite thoroughly several examples of the family Clausidiidae. Canu has, in fact, presented in his paper establishing this family (Canu, 1888) not only a most complete and exacting study of his examples, but one of the most admirable and useful papers ever published in the field of the Copepoda.

Giesbrecht (1893) in his redescription of *Clausia lubbockii* stated that *Clausia*, like *Hersiliodes*, shows relationship through the structure of both pairs of antennae, the maxilla and the mandible, to the Oncaeidae. Canu also commented on this. In his paper on *Mesnilia* (Canu, 1898) he recorded the genus thus: "Fam. incerta (Hersiliidae pars?)" and in discussion stated that "*Mesnilia* and *Clausia* approach in many points the Hersiliidae¹ and the Oncaeidae." It appears to us that the Oncaeidae present a rather confused complex of characters, some of which are primitive for the Poecilostoma, others highly derived planktonic modifications, so that it would seem impossible to arrive at such a far reaching conclusion as these earlier workers did. The differences between the Clausiidae and Clausidiidae, however, are of a less encompassing nature, and there is doubtless a valid and close relationship between them. Indeed, further study may reveal intermediate conditions such as seem to exist in the mandible of *Teredicola*, so that copepod systematics may best be served by merging the two families or by establishing an inclusive higher category.

The Clausiidae exhibit more evidences of reduction than is found in the commonly known genera of the Clausidiidae (*Clausidium*, *Hemicyclops*, *Hersiliodes*). In spite of this, there are strong resemblances, particularly in the second antenna with its tendency to reduction and offset position of the ultimate segment, and in the armature of the mandible. It may be of systematic importance that in these two groups, the terminal portion of the mandible blade is more or less expanded and always strongly directed posteriorly. The modified apical pieces, some of which are always stout setae when more than one is present, do not all arise in exactly the same plane, but are instead attached to separate

¹The Hersiliidae is the present day Clausidiidae, renamed by Embleton (1901).

lobes or arranged in an irregular series around the more or less thickened apex of the blade. This forms a striking contrast to the anteriorly directed, flattened blade of the well known *Ergasilus*, of *Myicola*, and of the genera of the Lichomolgidae.

Paragnaths, which are lacking in the Ergasilidae and Lichomolgidae, are present in the Clausidiidae. They have not been reported in the literature on the Clausiidae, but in two instances, their presence is suggested. In the illustration of the oral area of *Mesnilia* (Canu, 1898, pl. 8), the first maxilla is depicted as having an accessory lobe. Canu has described the appendage thus: "Les maxilles se composent d'une partie basilaire armée de deux soies courtes vers l'intérieur et prolongée par un lobe distal saillant au-dessus de la base des mandibules et accompagné de trois soies en partie barbelées." The illustration does not present any evidence that the three setae are part of the projecting lobe, and the question arises as to whether it is actually a part of the maxilla. Since Canu has so adequately recognized paragnaths in the Clausidiidae, one would expect him to interpret them correctly if they are present in *Mesnilia*. As this structure is so peculiar, however, it would be well that *Mesnilia martinensis* be reexamined for a more complete delineation of the first maxilla and the possible presence of paragnaths. Such study might be most instructive if direct comparison could be made with specimens of *Clausia lubbockii* which also has a comparatively large first maxilla.

Canu (1898, p. 402) in suggesting that *Clausia cluthae* T and A. Scott (1896) might be referable to *Mesnilia*, pointed out that knowledge of the buccal appendages is imperfect. Examination of the illustrations of this species certainly bears this out, and we suggest that either the captions have been transposed, or that the appendages have been confused with one another in dissection. The magnification given for figure 7 (X 760) is much greater than that for the other figures so the appendage must be smaller. From both this lesser size and its structure it seems likely that this figure represents the mandible, although it is labeled "anterior foot jaw" (second maxilla). Figure 5 is labeled mandible, but both structure and comparative size suggest that the lobe bearing the three setae is the first maxilla or a portion of it. The hairy lobe partially overlying the setiform structure may well represent a paragnath. Figure 6, labeled "maxilla" may be a modified terminal portion of the second maxilla or of the maxilliped, similar to that depicted for *Mesnilia martinensis*. When this species is reexamined the possibility of such confusion should be borne in mind.

Structures interpretable as paragnaths have been found in *Teredicola*. These are simple, unornamented, lobed swellings jutting up from the ventral surface posterior to the mandible and filling the space just distad to the inner portion of the maxilla. Sinuous, ornamented paragnaths are present in a similar position in *Myocheres major*.

The Need for Further Study

In the discussions of the genera concerned in this review, it has been necessary to qualify the interpretation of, or suggest the need of further investigation of many structures and genera. It should be well recognized by all workers in the Pöccilostoma that with such incomplete

knowledge, it is impossible to delimit many of the genera in family groups. This appears to be the result of two circumstances:

1. The inadequacy of collections, suggesting that many forms are yet unknown.
2. The inadequacy of description, particularly of the details of the seemingly fundamental characters found in the cephalic appendages and the impinging structures of the buccal area.

It is important, therefore, that the student of these copepods direct himself to careful and systematic collecting, and to precise, detailed study of the specimens. The proposal or acceptance of genera or species based only upon body shape, or upon appendages such as the antennule, the posterior oral appendages, and thoracic appendages, which appear to have a limited systematic importance, will always lead to confusion. We do not feel that we are being too exacting to suggest that no species or genus should be proposed without thorough delineation of all the appendages. Particular attention should be given to the exact details of the antenna and the mandible. The buccal region should be studied both *in situ* and in dissection, for the relationships of the appendages and the character of the surrounding structures, such as the labrum, labium, paragnaths and postoral protuberances are also of systematic importance. It is only through such description that we will gradually come to know these puzzling copepods well enough to derive the critical concepts necessary to delimit and establish higher categories.

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